Computerized Clinical Information

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The use of computers for medical practice has not evolved as rapidly as might be expected. Even though MEDLINE searches are universally used for in-depth search of medical information, the effective use of computers in direct patient care has had very limited acceptance.[1] The Waianae Coast Comprehensive Health Center (WCCHC) has supported the development of an in-house computer billing and information system, Pacific Area Medical Manager (PAMM), that includes a Patient Health Status (PHS) module. Through local development of the system, physicians are involved in every level of planning the PHS. Acceptance of the computer system by physicians has increased.

The Waianae Coast Comprehensive Health Center is operated by the Waianae District Comprehensive Health and Hospital Board, Inc., a private, nonprofit corporation established in 1969. WCCHC has been in operation since 1973 and serves the residents of the Waianae Coast from Kaena Point to Makakilo. The basic philosophy of WCCHC is to provide quality health services to community residents regardless of their ability to pay.

On July 4, 1991, WCCHC implemented the billing and collection system—PAMM. The system runs on a Hewlett Packard 3000 minicomputer and currently supports about 90 users around the clock. Since its implementation, many new features have been added to PAMM based on WCCHC's needs, including a fully featured appointment-scheduling module and an evolving PHS module. The implementation of the PHS module is a major step toward the goal of incorporating clinical data into the overall system.

The PHS module is designed to maximize existing demographic and medical information used in the billing system and to minimize the need for clinical personnel to input data or to interact with the computer. It is developed in stages with the physicians involved in deciding priority areas to designing screen formats. It is directed toward improving medical practice by using selective information rather than replacing or duplicating the complete medical record.[2]

Computerized medical information soon will be essential to medical practice. An example of the current use of the PHS describes the process and the principles involved in the system's development: Control of hypertension slows the devolution of diabetic nephropathy; effective control is important in delaying the onset of renal failure.[3] The U.S. Indian Health Service (IHS) recently completed a chart audit review of the care of diabetes including an assessment of the control of hypertension.[1] WCCHC carried out a similar study using data captured in the PHS vital-signs file.

Methodology

The vital signs—blood pressure, weight and blood glucose—have been recorded at WCCHC in patients with hypertension or diabetes since 1992. The average blood pressures for the most recent 3 visits were calculated for all patients with diabetes. Data on patients with fewer than 3 visits was entered and the sex and age were extracted from the demographic information in the billing system.

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Results

A total of 469 patients with diabetes were evaluated, and the cohort included 55% men and 45% women. Analysis of the data indicated that 39% of the patients had blood pressures >140/90. A complete breakdown according to the level of blood pressure control is shown in Table 1.

The number of patients with poorly controlled blood pressure increased from 13% in those under 35 years of age to 61% in patients over 75 years of age. Table 2 incorporates these data. Table 3 shows the breakdown according to the number of visits. Only 15% of the patients with diabetes had a single visit; the majority of patients had 3 or more visits.

Discussion

The findings generated in a short time on the computer indicate 39% of the population with diabetes at WCCHC have poorly controlled hypertension similar to the IHS results.[1] Previous evaluation by the Hawaii State Diabetes Control Program of the Waianae population with diabetes estimated that 60% of patients with diabetes also have hypertension. An estimated two-thirds of patients with diabetes had inadequate control based on outcomes.[4] Half of those who failed to reach the 140/90 blood pressure level were in the group with systolic blood pressures between 140 and 150. Since the principal objective of our study was to discuss the medical application of the computer, the actual results of the study will not be discussed further.

TABLE 1: Patients with diabetes who have elevated average blood pressures.

Blood Pressure	Patients With Elevated BP	Percentage
135/85*	246	52
140/90*	184	39%
140	168	36%
150	92	20%
160	39	08%
170	18	04%
180	08	02%

*Either systolic or diastolic blood pressure elevated over this value

In contrast to that done by the IHS, our computerized PHS allowed for 100% sampling. Chart reviews are time consuming and results then need to be entered into a computer for any complex analysis. By having the raw data stored in the computer, we were able to store and reproduce the data with little investment of time and to give feedback to our clinical personnel pertaining to the treatment of hypertension in patients with diabetes.

One of the principal reasons why WCCHC supported the development of the PAMM system was to have available the link between the PHS and the other functions, such as claims processing, scheduling, and reporting. Similar to the computerized "mini-record" reported from North Carolina[5], our system is being developed in stages according to priorities. This approach is in contrast to many systems that have attempted to capture the entire medical record.[6] PAMM captures the medical information that will directly affect patient care as well as evaluating the provider. Capturing the

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entire medical record on the other hand required acceptance by all the providers of a completely developed program that met the needs of all who use the medical records.[7] By using data captured in the billing system, our PHS module collects data with a minimal amount of superfluous entry. The way the program is structured permits the insertion of new data sets linked to existing data sets with minimal change in the core program; this allows the PHS module to be developed in successive stages.

The vital signs file, developed to track the outcomes of treatment of patients with hypertension and diabetes, required new blocks (fields) for blood pressure, blood glucose, weight and height on our encounter form: The nurse records vital signs at the time of encounter; this is entered into the computer for billing. Any patient seen for diabetes (ICD-9 codes 250.0 to 250.9) has weight and blood-glucose recorded; those who also have hypertension (ICD-9 codes 401. to 401.9) have those data entered. The encounter forms that do not have the required data are rejected by the computer and returned to the nurse for completion. Our staff rapidly learned to complete encounter forms correctly to avoid the hassle of having the forms returned.

We currently are introducing immunization history and health maintenance information (periodic screening-mammography, Pap smear, stool guaiac, sigmoidoscopy, physical exam, EKG, eye exam, etc.) on all patients into the computer. The billing system has been using specific CPT codes for specific preventive services. Using these codes and the concomitant dates of service from the existing billing information of the last 5 years, we were able to construct health-maintenance data files. Active collection of other data by the clinical staff is required only when it is needed. At the time of the encounter PAMM identifies patients who need immunizations or preventive health measures. It eliminates the need for the nurse or the physician to seek that information from the patient or the chart. "Flagging" for certain items has to be entered into the computer by a nurse or physician.

TABLE 2: Patients with diabetes with high blood pressure (HBP) systolic >140 or diastolic according to age.

Age	HBP	Total	%HBP
<35	8	60	13.33%
35 - 44	19	70	27.14%
45 - 54	56	127	44.09%
55 - 64	47	111	42.34%
65- - 74	37	73	50.68%
> = 75	17	28	60.71%
		total 469	

TABLE 3: Evaluation of patients with diabetes and hypertension by the frequency of visits.

Number of Visits	Patients with HBP	Total Number of Patients	%HBP	Average Age
1	22	69	31.9%	47.73
2	17	55	30.91%	51.15
3 or more	145	345	42.03%	54.17

Current projects include developing a patient problem list, a perinatal and family planning tracking and outcome system, and the additional use of the vital-sign file (height and weight) to measure pediatric growth and development. Future projects include the addition of files of laboratory data and of lists of medication.

Physician acceptance of the PHS is essential. They need to see clearly the clinical value of the computerized data in order to further the process. Previous studies have demonstrated acceptance by providers when they feel patient care is improved by this means[8] and improved overall care as instant reminders for preventive health care show up on the screen.[9]

The PHS system is designed to provide important information to the physician about the patient with minimal disruption of patient care. The providers do not actually have to interface with the computer, but are trained to use the on-line information of the PAMM system if they are interested.

With the development of the PHS, quality assessment of care at WCCHC will be strengthened. The measurement of practice patterns and medical outcomes by this process can be expected to replace current quality-assurance programs based on limited chart audits and peer review, a method that recently has come under critical review.[10,11,12] The report to the providers regarding the control of hypertension in patients with both diabetes and hypertension is intended to have an impact on patient management. Serial reports will provide feedback to clinicians as to theraputic progress and whether this technique will improve patient care.

We are rapidly expanding our use of PAMM in the area of quality assessment. Developing an effective quality assessment program not only improves patient care, but is increasingly important to the purchases of care and to consumer groups.

Conclusion

PAMM with PHS has some unique features that allow the providers, the users of the system, to deal with the rapidly changing aspects of medical care. Local innovative developments not only allow for programs sensitive to local needs, but also speed modification of QUEST, the revamping of Medicaid reimbursement. The system is designed to develop a quality-improvement program based on selective measurements of outcomes and practice patterns, rather than by limited case reviews or existing peer review programs.

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